



Experimental investigation of ice accretion on wind turbine blades

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Experimental investigation of ice accretion on wind turbine blades

Winterwind 2013 – International Wind Energy Conference

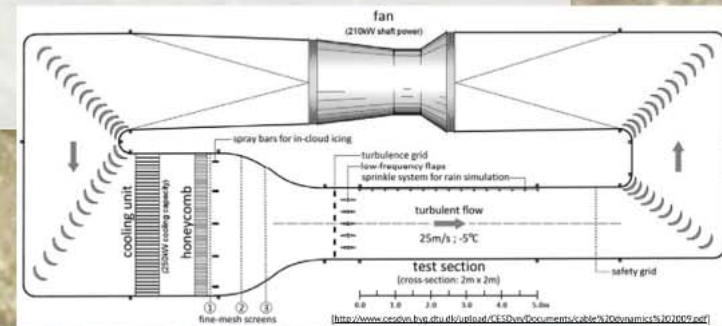
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Martin O. L. Hansen



Wind tunnel tests

- Climatic wind tunnel with icing conditions at Force Technology in Kgs. Lyngby, Denmark
- Naca 64-618 profile - from LM Wind Power
- Different angles of attack and temperature
- Glaze and mix ice tests
- MVD~25 micron
- Ice accretion for 60 minutes
- $Re=900.000 - 1.000.000$

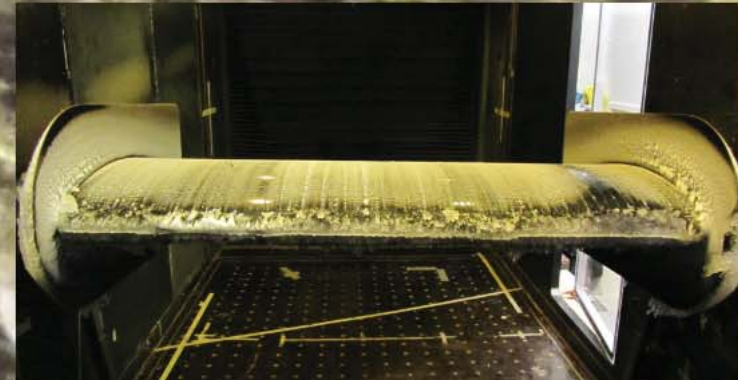


Wind tunnel tests

Before

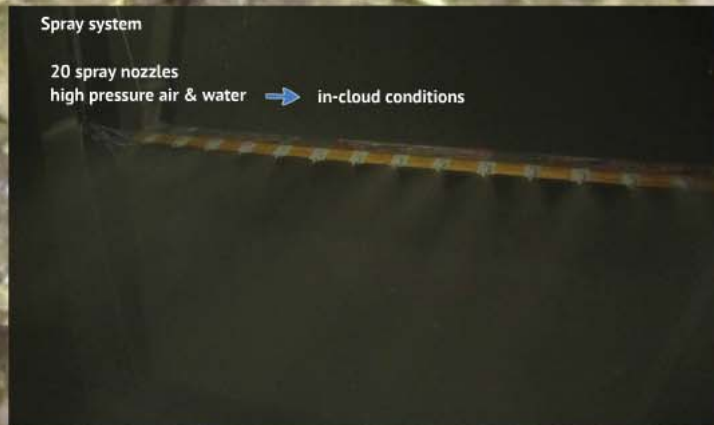


After



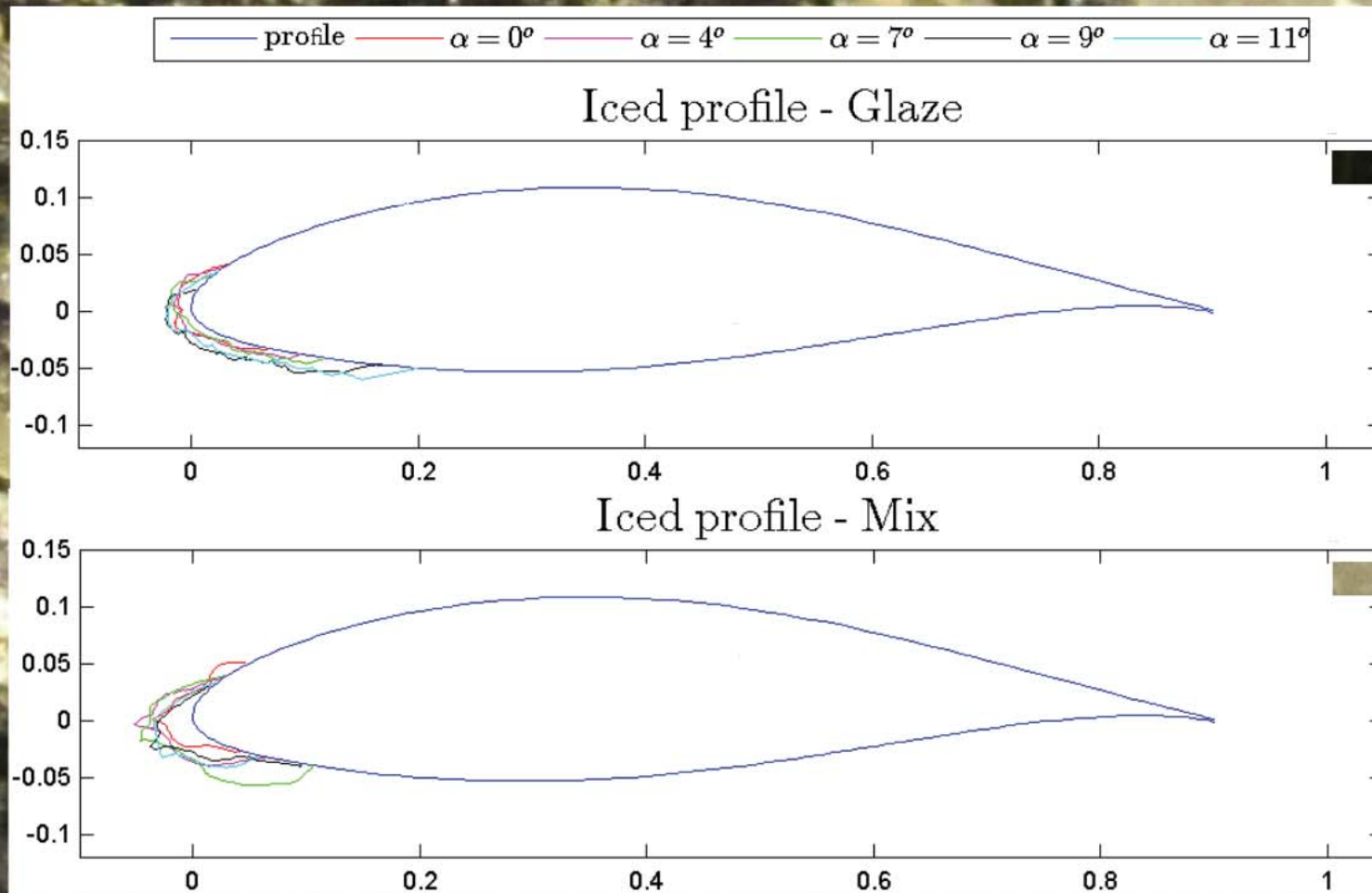
Spray system

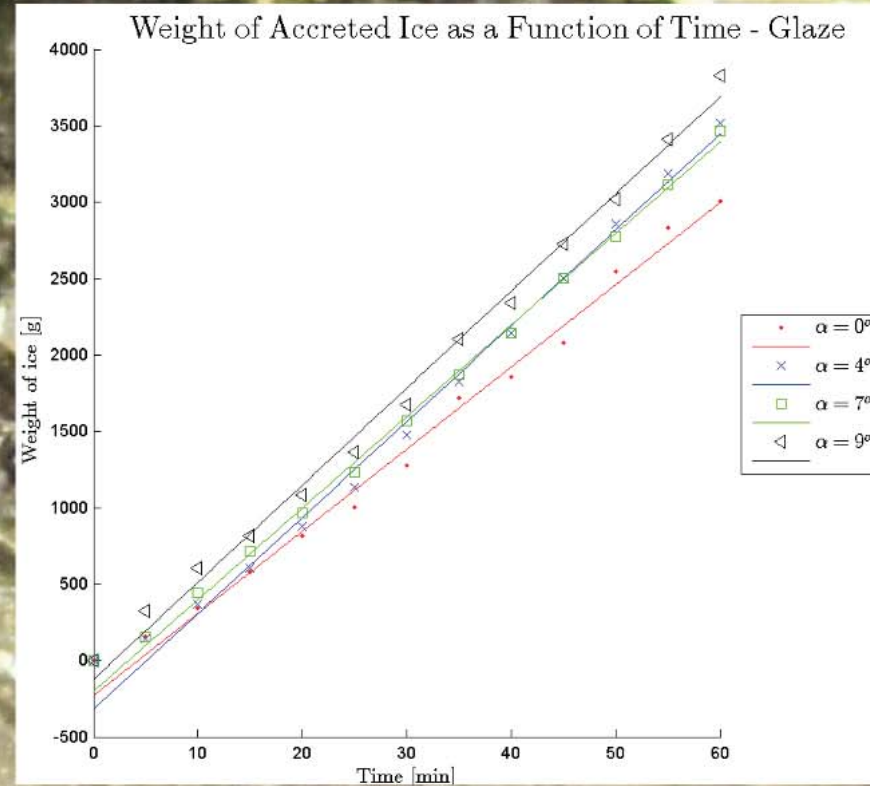
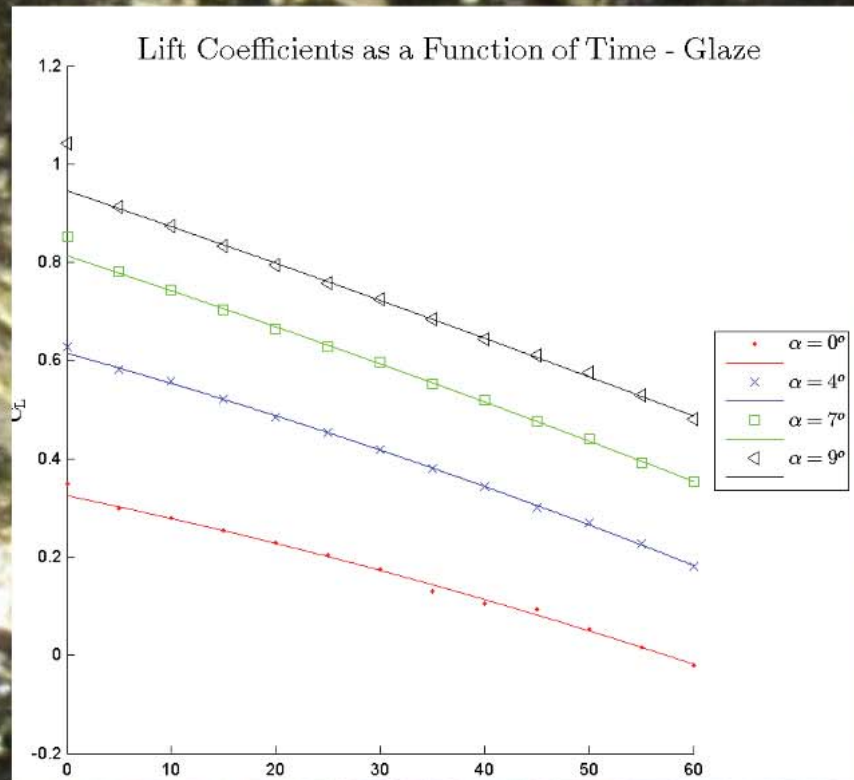
20 spray nozzles
high pressure air & water → in-cloud conditions



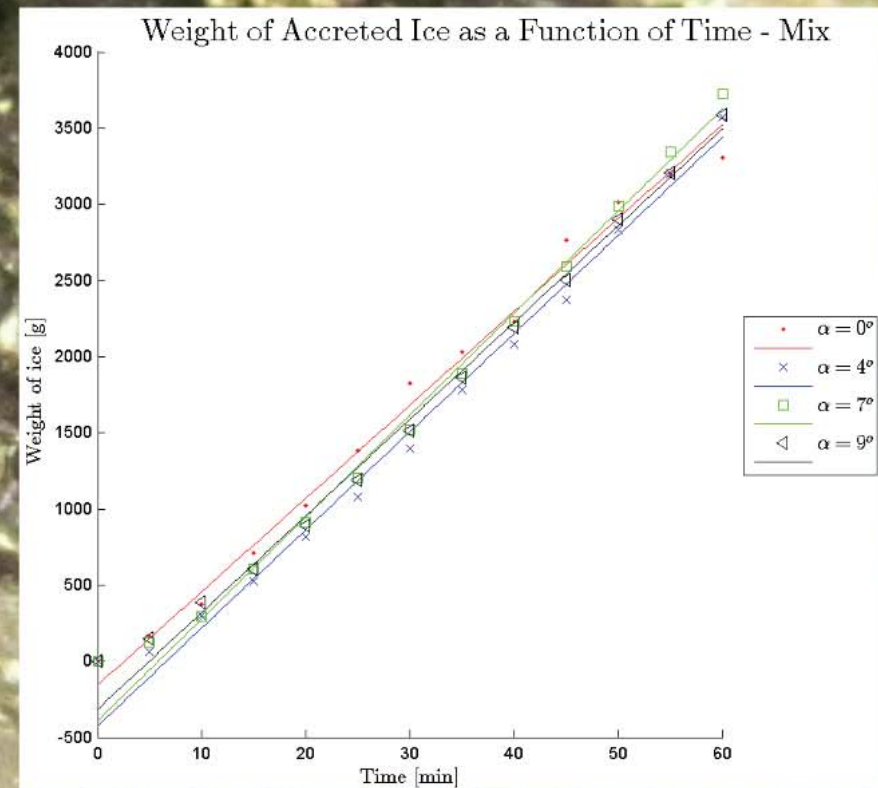
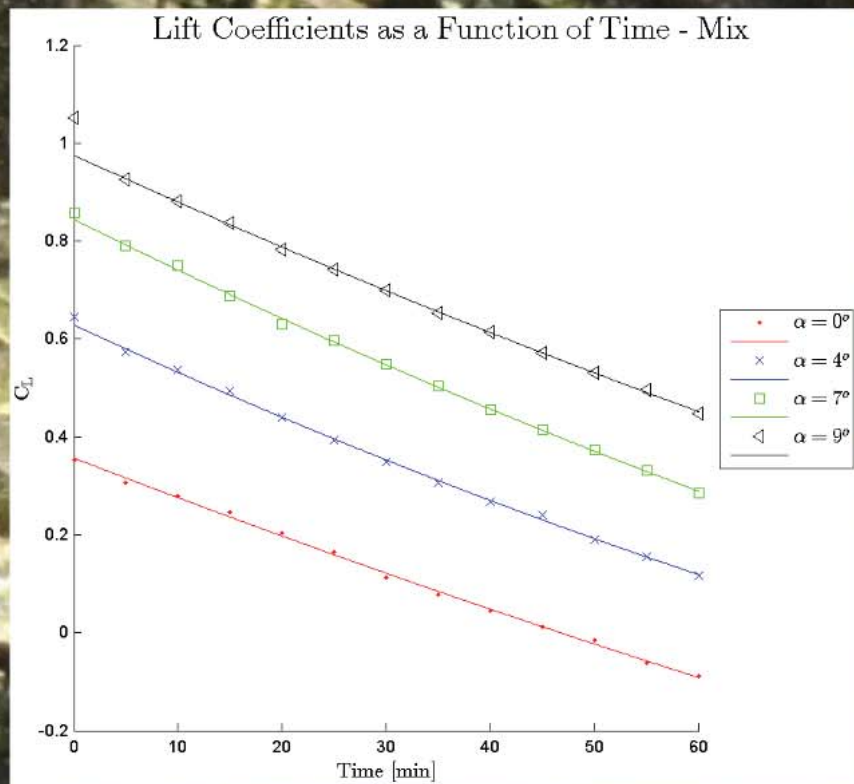


Results - profiles





Results -ice and aerodynamics



Main findings:

- **Linear ice accretion**
- **Dramatic lift coefficient degradation**
- **Most amount of ice accretion and least decrease in Cl for 9 deg AOA - glaze tests**
- **Least amount of ice accretion and most decrease in Cl for 0 AOA**

Further plans:

- **Include rime ice tests**
- **Comparison of the three different ice types**
- **Numerical analysis of the profiles**

Thank you for your attention!
If you have any questions, contact:
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